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Analysis of endogenous aldehydes in human urine by static headspace gas chromatography–mass spectrometry

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Endogenous aldehydes (EAs) are intermediary or final products of the metabolism involved in a wide spectrum of biochemical and physiological processes, such as oxidative stress and cell processes. This research reports a solvent-free and automated analytical method for the determination of EAs in human urine using a static headspace generator sampler coupled with gas chromatography–mass spectrometry (HS–GC–MS). Twelve significant EAs used as markers of different biochemical and physiological processes, namely short- and medium-chain alkanals, α,β -unsaturated aldehydes and dicarbonyl aldehydes were selected as target analytes. Direct human urine samples (no dilution is required) were derivatized with O-2,3,4,5,6-pentafluorobenzyl hydroxylamine in alkaline medium (hydrogen carbonate–carbonate buffer, pH 10.3). The analytical method allows the simultaneous derivatization and extraction of EAs in human urine, completing the entire process in 20 min. The HS–GC–MS method developed renders an efficient tool for the fast, sensitive and precise determination of EAs in human urine with limits of detection from 1 to 15ng/L and relative standard deviations, (RSDs) from 6.0 to 7.9%. Average recoveries by enriching urine samples ranged between 92 and 95%. Aldehydes were readily determined at 0.005–50 $\mu\text{g/L}$ levels in human urine from healthy subjects, smokers and diabetic adults. The twelve aldehydes under study were detected in the whole array of human urine samples analyzed. The quantification of aldehydes in those samples showed significantly differences in their concentrations when comparing smokers and diabetics to healthy subjects.

Biography

Manuel Silva completed his PhD in 1978 at University of Seville. He is Full Professor and Head of the Department of Analytical Chemistry at University of Córdoba. He has published about 150 papers in reputed journals. In the last decade, his research has been focused on the detection of aldehydes as water disinfection by-products and their distribution in treated water. He has directed 15 PhD theses and has worked in several organizations at the Ministry of Education and Science.

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